broad, obtuse form of beak; and I confess that the general conformity of cranial structure under the modifications illustrated in the present Memoir do not promise an advantage, by drawing a line which must be more or less arbitrary in whatever direction, equivalent to the imposition of two names for such divisions of a group of species so natural and closely allied as I would at present indicate by the sole generic name Dinornis.

On the Cranium of a Gigantic Bird (Dasornis londinensis, Ow.) from the London Clay of Sheppey, Kent.

The study and foregoing illustrations of the cranial structure of the recently extinct species of large terrestrial birds, induce me no longer to defer communicating similar evidence of one which passed away at a much more remote period of geological time. This evidence is the cranial part of the skull, which has been reduced by rough usage of the elements to a similar state with that of the cranium of Dinornis giganteus above described (p. 277). Very little of the outer table of the walls of that cavity is preserved; and much of the thick pneumatic diploë is exposed, not only along the upper (parieto-frontal) walls, but at the back and base of the cranium.

To this state it appears to have been brought, probably in its transport seaward by the mighty eocene river, prior to petrifaction in the mud with which it finally became enveloped. In the mass of such matrix, converted into petrified “London clay,” of which geological formation the Isle of Sheppey now mainly consists, this cranium was gathered with other eocene fossils, and was obtained from a local collector by the Earl of Enniskillen, F.R.S., to whom I am indebted for the opportunity of describing it, and to Mr. Davies, of the Department of Geology, for first calling my attention to the specimen in a collection of Sheppey fossils which Lord Enniskillen had sent (for determination) to the British Museum.

In size this cranium equals that of the Dinornis giganteus; its proportions are also dinornithic, exemplified in the great breadth, small height, and forward slope of the occiput, in the flatness of the calvarium—with all the indications, in short, of low cerebral development. But there are well-marked differences as compared with Dinornis. The occipital condyle exceeds in size by 1 line that of Dinornis robustus in both vertical and transverse diameters; its shape is almost the same; and it is similarly impressed along the middle of its upper half by a vertical groove deepening, and in the fossil slightly expanding, to the end. This latter character is more marked in Dinornis elephantopus than in D. robustus; but the groove goes lower, and the hemisphere is more truncate above in D. elephantopus.

The condyle in the fossil shows, under the pocket-lens, the same fine punctate diploë, or cellular structure, as does the condyle in Dinornis, when the thin, smooth outer coat

1 δάσος, a thicket (in reference to the abundance of fossil fruits and other arboreal evidences associated with the remains of the large bird).
has been rubbed off. The foramen magnum is rather smaller, especially across, than in *Dinornis giganteus* or *D. robustus*; it resembles in shape that of the specimen of the latter species from the limestone fissure at Timaru, figured in Pl. LXII, fig. 2, o. The foramen has been overtopped, not by so sharp or narrow a penthouse as in *Dinornis robustus*, but by a thicker prominence of the combined ex- and super-occipitals, like that in *Casuarinus*, in *Dromaius*, and in *Dinornis gravis*. The abrasion of this part, and of the arc thence curving down to each paroccipital, exposes the diploë at many parts; where the outer table remains it shows the arched ridge to be broader and more smoothly rounded than in *Dinornis robustus*, more like that in *Dinornis elephantopus*; but the descending curve is less, the arch is wider, spanning more transversely to the paroccipitals: in the degree of transverse and vertical concavity of the area below the exoccipital arch *Dasornis* resembles *Dinornis robustus* rather than *Dinornis elephantopus*, in which the area is more depressed. The vagal foramina in this area, of which the right is plainly recognizable, open rather nearer the condyle than in *Dinornis*. In a direct upper view the condyle is visible, as in *Dinornis struthoides* and *D. dromioides*. It is plain from what remains of the basi-occipital tuberosities that they were developed from a tract not descending below the condyle in a degree beyond that in *Dromaius*; otherwise they resemble those protuberances in *Dinornis* in size and position. The super-occipital surface inclines from below forward in a degree as great as in *D. struthoides* and *D. dromioides*—consequently more so than in the larger Moas, much more so than in any of the existing *Struthionidae*, or in any aquatic or other known living bird.

Notwithstanding the degree of abrasion of the transverse superoccipital ridge, there is evidence of the two outer and larger curves, convex forward, continued as in *Dinornis struthoides* to the paroccipital ridges. These were inclined backward, as in *Rhea* and *Dinornis*; but to what degree, or how far the ridges descended, the broken specimen gives no information.

Against an indication of a short pterapophysis, on the right side, part of what is plainly a pterygoid abuts by its hinder end; this lamelliform bone extends forward and, as in *Rhea*, slightly outward, and joins a similar fragment of a lamelliform palatine which has been pressed upward into the orbit, above the level of the presphenoidal rostrum. Of this rostrum, a length of nearly two inches is continued forward from the basisphenoid; its wide-celled pneumatic structure is exposed, as one sees in similarly abraded *Dinornis*-skulls. To the left of the anterior broken end of the rostrum, in the same relative position as in *Dinornis robustus*, is a portion of the hind part of a broad palatal plate of the premaxillary; and sutureally connected therewith is the palatal process of the maxillary, fractured across where it was contracting and thickening to join the palatine bone.

On the left side of the cranium, part of the smooth upper surface is continued upon a process arching downward, which I regard as homologous with the postfrontal in *Dinornis*; the broken termination shows a fore-and-aft breadth of 5 lines, a transverse
thickness of 2 lines; and the fracture exposes the same open pneumatic diploë as in *Dinornis*. This process is distant from the back part of what remains of the paroccipital process 1 inch 3 lines. It is consequently nearer that process, being more backwardly situated, than in *Dinornis robustus* or *D. elephantopus*. But the Moas differ among themselves in this respect, according to, or with concomitant differences in, the antero-posterior extent of the temporal fossæ. Thus *Dinornis rheïdes* more resembles *Dasornis* in this respect. But in the proximity of the postfrontals to the occiput *Dasornis* still more nearly resembles *Struthio*; and the resemblance extends to a concomitant large expanse of the superorbital arch.

Again, we find in what is preserved of the fore part of the cranium a marked departure from the dinornithic type, and an adhesion as well marked to that of existing *Struthionidae*. The fore half of the interorbital part of the frontals is contracted, as in *Rhea* and *Dromaius*, and is concave transversely, as in *Rhea*. To its sides articulate the broad hind parts of a pair of bones which I regard as homologous with the two distinct nasals in *Rhea* and *Struthio*. These parts of the nasals, beginning narrow, or by a point, behind, rapidly expand and meet as they advance, so as to give a pointed form to the included part of the calvarium. Whether this part be the frontal, or an exposed surface of the connate prefrontals, the abraded surface of the bone does not permit to be defined with certainty.

The structure of this interesting fossil, as far as it can be defined, shows it to be of a bird; its configuration and proportions exemplify combinations of dinornithic and modern struthious characters. What the mandibles may further prove, time, we will hope, may discover. But this I anticipate with confidence, that further acquaintance with the osseous structure of *Dasornis* will show it to be no exception to the flightless and terrestrial nature of all other known birds of like hugeness.

The present evidence of such a bird in so old a tertiary deposit as the London Clay at once recalled the discovery of the limb-bones of an equally gigantic bird by M. Gaston-Planté (tibia) and by Professor Hébert (femur) in the lower conglomerate of the eocene plastic clay at Meudon, near Paris. For the conclusions to which the study and comparison of these bones led me, I would refer the palæontologist to the Memoir quoted below¹, to which M. Alphonse Milne-Edwards has done me the honour to refer². I will only add that the main part of the shaft of the fibula of *Gastornis* has been more recently discovered in the same formation at Passy, near Paris³, which exhibits as extensive a con-

¹ "On the Affinities of the large Extinct Bird (*Gastornis parisiensis*, Hébert), indicated by a fossil femur and tibia discovered in the lowest eocene formation near Paris."—Quarterly Journal of the Geological Society of London, vol. xii. p. 204, pl. 3 (1856). I am glad to find, carefully reperusing this Memoir, that it affords no ground for the difference alleged to exist between myself and the accomplished writer of the following remarks:—"Je ne puis partager l'opinion de M. Owen relativement aux rapports qui existent entre le *Gastornis* et les oiseaux du groupe des Rallides."—Alphonse M.-Edwards, Recherches Anatomiques et Paléontologiques pour servir à l'Histoire des Oiseaux Fossiles de la France, 4to, p. 172.


nexion with the tibia, and proportions almost as massive and robust as the fibula of *Dinornis*, like which genus, *Gastornis* will probably prove to be tridactyle and terrestrial. It is possible (one cannot venture to say more) that the cranial fragment here described may belong to the same genus as the Parisian eocene large bird.

**DESCRIPTION OF THE PLATES.**

**PLATE LXXV.**

*Dinornis rheides.*

Fig. 1. Side view of skull.
Fig. 2. Back view of cranium.
Fig. 3. Top view of cranium.
Fig. 4. Base view of cranium.
Fig. 5. Top view of mandible.
Fig. 6. Back view of left ramus of mandible.
Fig. 7. Inner view of left ramus of mandible.
Fig. 8. Inner view of right zygomatic arch.
Fig. 9. Outer view of right tympanic.
Fig. 10. Inner view of right tympanic.

**PLATE LXXVI.**

*Dinornis crassus.*

Fig. 1. Side view of skull.
Fig. 2. Upper view of skull.
Fig. 3. Under view of skull.
Fig. 4. Back view of cranium.
Fig. 5. Inner surface of tympanic.
Fig. 6. Outer surface of tympanic.
Fig. 7. Inner surface of mandibular ramus.
Fig. 8. Under view of mandibular ramus and symphysis.
Fig. 9. Upper view of mandibular ramus and symphysis.

1 In the Memoir quoted by M. Alphonse Milne-Edwards, the following ‘Rapports’ between *Gastornis* and *Dinornis* are thus indicated:—‘Interesting, unquestionably, is the median position of the supratendinal bridge in *Gastornis*; and it would indicate affinities to the Swan and Goose, were not the same bridge equally medianly situated in the Gallinule, the *Notornis*, the Raven, some Accipitrine birds,” &c. “The inclination of the canal to the inner side, and the position of the lower outlet to the left of the median plane, in *Gastornis*, while it is a departure from the Anserine type, is an approximation to the Gallinaceous and Dinornithic structures.”—Quarterly Journal of the Geological Society, vol. xii. p. 215. And, again, “In the aspect of the lower outlet of the tendinous canal the *Gastornis* more resembles the known larger wading and land birds and the *Dinornithide* than it does any aquatic bird.”—Ib. p. 216. “The proportions of the tibia, its thickness *e. g.* in proportion to its length, would plainly show that the Parisian eocene bird had more robust and shorter legs than the typical waders, and probably was, as other birds of like dimensions, better adapted for terrestrial life.”—Ib. p. 216.
PLATE LXXVII.

_Dinornis elephantopus._

Fig. 1. Side view of skull (wanting zygoma).
Fig. 2. Back view of cranium.
Fig. 3. Upper view of cranium.
Fig. 4. Under view of cranium.
Fig. 5. Front view of cranium.
Fig. 6. Upper view of premaxillary.
Fig. 7. Under view of premaxillary.
Fig. 8. Under view of symphysial end of mandible.
Fig. 9. Upper view of symphysial end of mandible.

PLATE LXXVIII.

_Dinornis casuarinus._

Fig. 1. Side view of skull (wanting zygomatic and palato-pterigoid arches).
Fig. 2. Upper view of cranium.
Fig. 3. Under view of cranium.
Fig. 4. Upper view of premaxillary.
Fig. 5. Under view of premaxillary.
Fig. 6. Inner side of left mandibular ramus.
Fig. 7. Under view of symphysial end of mandible.
Fig. 8. Upper view of symphysial end of mandible.

_Dinornis giganteus._

Fig. 9. Vertical longitudinal section of cranium.
Fig. 10. Inner side of right mandibular ramus, mutilated.
Fig. 11. Under surface of symphysial end of mandible.
Fig. 12. Upper surface of symphysial end of mandible.
Fig. 13. Inner side of left tympanic of _Din. casuarinus._

PLATE LXXXI.

_Dinornis gravis._

Fig. 1. Side view of skull.
Fig. 2. Back view of cranium.
Fig. 3. Top view of cranium.
Fig. 4. Base view of cranium.
Fig. 5. Top view of symphysis mandibulae.
Fig. 6. Top view of symphysis mandibulae of _Dinornis crassus._
Fig. 1. Side view of skull.
Fig. 2. Back view of cranium.
Fig. 3. Base view of skull (minus mandible).
Fig. 4. Reduced side view of skull (ex Jaeger, loc. cit.).

All the figures are of the natural size; the numerals and letters are explained in the text.